CHAPTER 1

INTRODUCTION TO BIOLOGY

MULTIPLE CHOICE QUESTIONS

1. **How many elements make 99% of total body mass?**
(a) 6 (b) 8 (c) 10 (d) 12
2. **The microscopic study of tissues:**
(a) Morphology (b) Anatomy (c) Histology (d) Cell biology
3. **Which branch of Biology deals with the study of form and structures of living organisms?**
(a) Morphology (b) Anatomy (c) Histology (d) Cell biology
4. **The study of internal structures of living organisms:**
(a) Morphology (b) Anatomy (c) Histology (d) Cell biology
5. **The study of the structures and functions of cells and cell organelles is:**
(a) Morphology (b) Anatomy (c) Histology (d) Cell biology
6. **The brach of Biology that deals with the study of social behaviour of the animals that make societies:**
(a) Socio-biology (b) Parasitology (c) Entomology (d) Immunology
7. **Which book is written by Bu Ali Sina?**
(a) Al-Nabatat (b) Al-Wahoosh (c) Al-Qanun-fi al-Tib (d) None of these
8. **Percentage composition of oxygen in the protoplasm of living organisms:**
(a) 31% (b) 65% (c) 77% (d) 43%
9. **Percentage composition of hydrogen in the protoplasm of living organisms:**
(a) 10% (b) 20% (c) 30% (d) 40%
10. **Which of the following is a micromolecule?**
(a) Starch (b) Protein (c) Lipid (d) Glucose
11. **The area of the environment in which organism lives:**
(a) Ecosystem (b) Habitat (c) Species (d) Biosphere
12. **Number of major groups in which all the organisms have been divided:**
(a) 2 (b) 3 (c) 4 (d) 5
13. **Which one organism has colonial mode of life?**
(a) *Amoeba* (b) *Paramecium* (c) *Volvox* (d) *Euglena*
14. **Mustard plant is sown in:**
(a) Summer (b) Winter (c) Spring (d) Autumn
15. **Which one is the reproductive part of the plant?**
(a) Stem (b) Root (c) Leaf (d) Flower

ANSWERS:

1	a	2	c	3	a	4	b	5	d
6	a	7	c	8	b	9	a	10	d
11	b	12	d	13	c	14	b	15	d

SHORT QUESTIONS

Q. No. 1 What is Science?

SCIENCE

"The study of nature is called science."

Q. No. 2 Why was the scientific information not classified into different branches?

CLASSIFICATION OF SCIENCE

In ancient times, the scientific information was not classified into different branches, as it exists today. All the scientific information was included under one head i.e. 'science'. With the passage of time scientific information increased many folds and this enormous scientific knowledge was then classified into different branches like:

- Biology
- Physics
- Chemistry
- Mathematics etc.

Q. No. 3 What is the benefit of the study of living things?

BENEFIT OF STUDY OF LIVING THINGS

The study of living organisms provides information and remedies to human problems regarding:

- Health
- Food
- Environment etc.

Q. No. 4 Define Biology.

BIOLOGY

"The scientific study of life is called Biology."

Q. No. 5 From where the word Biology has been derived? What does it mean?

MEANING OF BIOLOGY

The word "biology" has been derived from two Greek words.

'bios' meaning 'life'

'logos' meaning 'thought or reasoning'

Q. No. 6 What are Major Biological Issues?

MAJOR BIOLOGICAL ISSUES

The major biological issues of today are as follow:

- Human population growth
- Infectious diseases
- Addictive drugs
- Environmental pollution

Q. No. 7 Define Habitat.

HABITAT

The area of the environment in which an organism lives is called habitat.

Q. No. 8 Describe an atom.

ATOM

An atom is composed of these three foundamental particles:

- Electrons
- Protons
- Neutrons

Protons and neutrons are located inside nucleus of atom while electrons orbit in energy levels (electron shells) around the nucleus. The number of electrons in the outermost shell determines the manner in which atoms react with each other.

Q. No. 9 What are Parasites?

PARASITES

The argnisms that take food and shelter from living hosts and, in return, harm them are called parasites. For example:

- Viruses
- Pathogenic Bacteria
- Some Worms
- Parasitic Fungi

LONG QUESTIONS

Q. No. 1 Describe divisions of Biology.

DIVISIONS OF BIOLOGY

There are three major divisions of biology which study the different aspects of the lives of these groups.

Zoology:

The division of biology deals with the study of animals is called Zoology.

Botany:

The division of biology deals with the study of plants is called Botany.

Microbiology:

The division of biology deals with the study of microorganisms is called Microbiology. For example:

- Bacteria
- Viruses etc.

Q. No. 2 Describe Branches of Biology.

BRANCHES OF BIOLOGY

1. **Morphology:** The branch of Biology that deals with the study of the form and structures of living organisms is called Morphology.
2. **Histology:** The branch of Biology that deals with microscopic study of tissues is called histology.
3. **Cell Biology:** The branch of Biology that deals with the study of the study of the structures and functions of cells and cell organelles is called cell biology. This branch also deals with the study of cell division.
4. **Physiology:** The branch of Biology that deals with the study of the functions of different parts of living organisms is called physiology.
5. **Molecular Biology (Biochemistry):** The branch of Biology that deals with the study of the molecules of life is called molecular biology.
   - Water
   - Proteins
   - Carbohydrates
   - Lipids
   - Nucleic acids

6. **Genetics:** The branch of Biology that deals with the study of genes and their role in inheritance is called genetics.
   Inheritance: The transmission of characters from one generation to the other is called inheritance.
7. **Embryology:** The branch of Biology that deals with the study of the development of an embryo to new individual is called embryology.
8. **Taxonomy:** The branch of Biology that deals with the study of naming and classification of organisms into groups and subgroups is called taxonomy.
9. **Palaeontology:** The branch of Biology that deals with the study of fossils is called palaeontology.
   Fossils: Fossils are the remains of extinct organisms.
10. **Environmental Biology:** It deals with the study of the interactions that exist between the organisms and their environment.
11. **Parasitology:** The branch of Biology that deals with the study of parasites is called parasitology.
    Parasites: Parasites are the organisms that take food and shelter from living hosts lives and, in return, harm them.
12. **Socio-biology:** The branch of Biology that deals with the study of social behaviour of the animals that make societies.
13. **Biotechnology:** The branch of Biology that deals with the study of the practical application of living organisms to make substances for the welfare of mankind is called biotechnology.
14. **Anatomy:** The branch of Biology that deals with the study of internal structure of living organisms is called anatomy.
15. **Immunology:** The branch of Biology that deals with the study of the immune system of animals, which defends the body against invading microbes is called immunology.
16. **Entomology:** The branch of Biology that deals with the study of insects is called entomology.
17. **Pharmacology:** The branch of Biology that deals with the study of drugs and their effects on the systems of human body is called pharmacology.

Q. No. 3 Describe relationship of Biology to other sciences.

RELATIONSHIP OF BIOLOGY TO OTHER SCIENCES

Interdisciplinary Sciences:

The interrelationship among different branches of science cannot be denied. Biology includes information on various aspects of living things but these information relate to the other branches of science as well. Each branch of science has relationships with all other branches. This forms the basis of interdisciplinary sciences.

Example: When studying the process of movement in animals, the biologists have to refer to the laws of motion in physics.

1. **Biophysics:** It deals with the study of the principles of physics, which are applicable to biological phenomena.
   Example: There is a similarity between the working principles of lever in physics and limbs of animals in biology.
2. **Biochemistry:** It deals with the study of the chemistry of different compounds and processes occurring in living organisms.
   Example: The study of basic metabolism of photosynthesis and respiration involves the knowledge of chemistry.

Figure: Relationship of Biology with other Sciences

3. **Biomathematics / Biometry:** It deals with the study of biological processes using mathematical techniques and tools.
   Example: To analyze the data gathered after experimental work, biologists have to apply the rules of mathematics.
4. **Biogeography:** It deals with the study of the occurrence and distribution of different species of living organisms in different geographical regions of the world.
   It applies the knowledge of the characteristics of particular geographical regions to determine the characteristics of living organisms found there.
5. **Bioeconomics:** It deals with the study of the organisms from economical point of view. It includes the study of the cost effectiveness and viability of biological projects.
   Example: The cost value and profit value of the yield of wheat can be calculated through bioeconomics and benefits or losses can be determined.

Q. No. 4 Write a note on careers in Biology.

CAREERS IN BIOLOGY

It is essential that students of today, who will occupy positions of leadership tomorrow, have the background of the modern and forward-looking branches of science.

Advantage: An accurate and modern knowledge of biology, would promote a comprehension of both science and scientific research projects, which would benefit the learners in diverse list of careers. The following are the careers that a student of biology can plan to adopt.

1. **Medicine / Surgery:** The profession of medicine deals with the diagnosis and treatment of diseases in human. In surgery the parts of the body may be repaired, replaced or removed.
   Example: The removal of stones through renal surgery, transplantation of kidney, liver etc.
   Study of Profession: Both these professions are studied in the same basic course (MBBS) and then students go for specializations.
2. **Fisheries:** Fisheries is the professional study of fish production.
   Departments in Pakistan: There are departments in Pakistan where professionals of fisheries are employed. They serve for enhancing the quality and quantity of fish production.
   Adoptation of Profession: In Pakistan, this profession can be adopted after the bachelor or masters level study of zoology and fisheries.
3. **Agriculture:** This profession deals with the food crops and animals which are the source of food, like buffalo, cow etc.
   Scope of Agriculture: An agriculturist works for the betterment of crops like wheat, rice, corn etc and animals from which we get food.
   Departments in Pakistan: In Pakistan there are many universities which offer professional courses on agriculture after the higher secondary education in biology.

4. **Animal Husbandry:** It is the branch of agriculture concerned with the care and breeding of domestic animals (livestock) e.g. cattle, sheep etc.
   Adoptation of Profession: Professional courses in animal husbandry can be adopted after the higher secondary education in biology.
5. **Horticulture:** This profession includes the art of gardening.
   Scope of Horticulture: A horticulturist works for the betterment of existing varieties and for the production of new varieties of ornamental plants and fruit plants.
   Adoptation of Profession: Biology students can adopt this profession after their higher secondary education.
6. **Farming:** It deals with the development and maintenance of different types of farms.
   Examples:
   - In some farms animal breeding technologies are used for the production of animals which are better protein and milk source.
   - In poultry farms chicken and eggs are produced.
   - Similarly in fruit farms, different fruit yielding plants are grown.

   Adoptation of Profession: A student who has gone through the professional course of agriculture, animal husbandry or fisheries etc can adopt this profession.
7. **Forestry:** In forestry, professionals look after natural forests and advise to the government for planting and growing artificial forests.
   Departments in Pakistan: Many universities offer professional courses in forestry after the higher secondary education in biology or after bachelor level study of zoology and botany.
8. **Biotechnology:** It is the latest profession in the field of biology. Biotechnologists study and work for the production of useful products through microorganisms.
   Departments in Pakistan. Many universities offer courses in biotechnology
   Adoptation of Profession The students of can adopt this profession after the higher secondary education in biology and after the bachelor level studies of botany or zoology.

Q. No. 5 Write Quranic Verses and their translation about the origin and characteristics of living organisms.

QURAN AND BIOLOGY

At many places in Holy Quran, Allah hints about the origin and characteristics of living organisms. In the same verses human beings have been instructed to expose the unknown aspects of life, after getting the hints. Here are few examples of such guidelines.

Verse:

وَجَعَلْنَا مِنَ الْمَآءِ كُلَّ شَيْءٍ حَيٍّ ۝

Translation: **"We made every living thing from water."**

(Sura: Ambia, Verse: 30)

Verse:

خَلَقَ الْاِنْسَانَ مِنْ صَلْصَالٍ كَالْفَخَّارِ ۝

Translation: **"He made man from clay like the potter."**

(Sura: Rehman, Verse: 14)

Verse:

ثُمَّ خَلَقْنَا النُّطْفَةَ عَلَقَةً فَخَلَقْنَا الْعَلَقَةَ مُضْغَةً

فَخَلَقْنَا الْمُضْغَةَ عِظٰمًا فَكَسَوْنَا الْعِظٰمَ لَحْمًا ○

Translation: **'Then fashioned We the drop a clot, then fashioned, We the clot a little lump, then fashioned We the little lump bones, then clotted the bones with flesh."**

(Sura: Al-Mominoon, Verse: 14)

Verse:

وَاللّٰهُ خَلَقَ كُلَّ دَآبَّةٍ مِّنْ مَّآءٍ ۚ فَمِنْهُمْ مَّنْ يَّمْشِيْ عَلٰى بَطْنِهٖ ۚ وَمِنْهُمْ مَّنْ يَّمْشِيْ عَلٰى رِجْلَيْنِ ۚ

وَمِنْهُمْ مَّنْ يَّمْشِيْ عَلٰٓى اَرْبَعٍ ۗ يَخْلُقُ اللّٰهُ مَايَشَآءُ ۗ اِنَّ اللّٰهَ عَلٰى كُلِّ شَىْءٍ قَدِيْرٌ ○

Translation: **"Allah hath created every animal from water. Then some of them creep up over their bellies, others walk on two legs, and others on four. Allah creates what He pleases."**

(Sura: Al-Nur, Verse: 45)

Conclusion:

Quran hints not only at the origin and development of life but also at many characteristics of living organisms. Scientists reveal such mechanisms.

Q. No. 6 Describe contribution of Muslim scientists in the field of Biology.

MUSLIM SCIENTISTS

Muslim scientists have made great contributions to the study of science and we are aware of their success in different fields of science. The work of Jabir Bin Hayan, Abdul Malik Asmai and Bu Ali Sina in the development of the present day knowledge of plants and animals is as follow.

Jabir Bin Hayan:

Period: (721 – 815AD)

Birth:

He was born in Iran

Practice:

He practiced medicine in Iraq.

Experimental Research Work:

He introduced experimental research in chemistry

Famous Books:

He also wrote a number of books on plants and animals. His famous books are

- "Al-Nabatat"
- "Al-Haywan".

Abdul Malik Asmai:

Period: (740 – 828AD)

First Muslim Scientist:

He is considered the first Muslim scientist who studied animals in detail.

Famous Books:

His famous writings include:

- "Al-Abil (camel)"
- "Al-Khail (horse)"
- "Al-Wahoosh (animal)"
- "Kalq al-ansan"

Bu Ali Sina:

Period: (980 -1037AD)

Founder of Medicine:

He is honoured as the founder of medicine

Name in West:

He was called as Avicenna in the West.

Specializations:

He was a physician, philosopher, astronomer and poet.

Famous Book:

His famous book "Al-Qanun-fi al-Tib" is known as the canon of medicine in West.

Photograph of Bu Ali Sina commemorated on a ticket Poland

Jabir-Bin-Hayyan

Q. No. 7 Write a note on subatomic and atomic level.

SUBATOMIC AND ATOMIC LEVEL

Elements:

All types of matter are made up of elements. Each element contains a single kind of atoms.

Meaning:

The word atom means: ('a': not, 'tom': cut)

Subatomic Particles:

These atoms are actually made up of many subatomic particles.

The most stable subatomic particles are:

- Electrons
- Protons
- Neutrons

Bioelements:

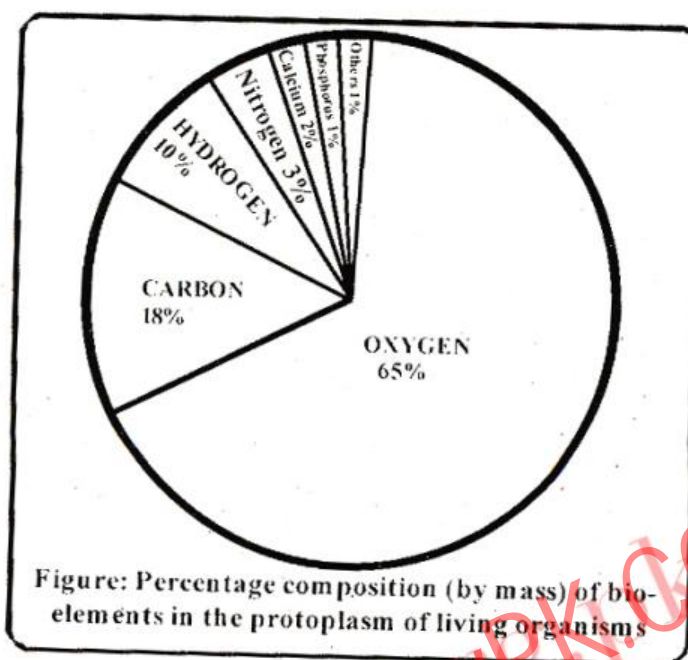
The elements which take part in the formation of body mass of living organisms are called bioelements

Number:

Out of the 92 kinds of elements that occur in nature, 16 are called bioelements.

Out of these bioelements;

- Only six (O, C, H, N, Ca, & P) make 99% of the total mass.
- Other ten (K, S, Cl, Na, Mg, Fe, Cu, Mn, Zn, & I) collectively make 01% of the total mass.

Figure: Percentage composition (by mass) of bio-elements in the protoplasm of living organisms

Q. No. 8 **Write a note on molecular level.**

MOLECULAR LEVEL

Molecule:

The smallest part of a compound that retains the properties of that compound is called a molecule.

Biomolecule:

In organisms, bioelements usually do not occur in isolated forms rather they combine through ionic or covalent bonding. The stable particle formed by such bonding is called as biomolecule.

Building Materials:

An organism is formed by enormous number of biomolecules of hundreds of different types. These molecules are the building material and are themselves constructed in great variety and complexity due to specific bonding arrangements.

Types of Biomolecules:

Biomolecules are classified as micromolecules and macromolecules.

Micromolecules:

Micromolecules are with low molecular weight.

Examples:

- Glucose
- Water

Macromolecules:

Macromolecules are with high molecular weights.

Examples:

- Starch
- Proteins
- Lipids

Q. No. 9 Write a note on organelle and cell level.

ORGANELLE AND CELL LEVEL

Organelles:

Biomolecules assemble in a particular way and form organelles.

Cell:

The organelles are actually sub-cellular structures and when they assemble together, cells are formed.

Division of Labour:

Each type of organelle is specialized to perform a specific function. Functions of the cell are accomplished by these specialized structures. It is an example of the division of labour within the cell.

Examples:

- Mitochondria are specialized for cellular respiration
- Ribosomes are specialized for protein synthesis.

Prokaryotes and Protists:

In the case of prokaryotes and most protests, the entire organism consists of a single cell.

Eukaryotes:

In the case of most fungi, all animals and all plants, the organism consists of up to trillions of cells.

Q. No. 10 Write a note on tissue level.

TISSUE LEVEL

Introduction:

In multicellular organisms, similar cells (performing similar functions) are organized into groups, called tissues.

Definition:

A group of similar cells specialized for the performance of a common function is called as tissue.

Specialization in function:

Each cell in a tissue carries on its own life processes, like:

- Cellular respiration
- Protein synthesis

But it also carries on some special processes related to the function of the tissue.

Examples:

Plant tissue:

There are different types of plant tissues:

- Epidermal tissue
- Ground tissue

Animal tissue:

There are different types of animal tissues.

- Nervous tissue
- Muscular tissue

Q. # 11 Write a note on organ and organ system level.

ORGAN LEVEL

Organ:

In higher multicellular organisms, particularly in animals, more than one type of tissues having related functions are organized together and make a unit, called organ.

Functioning:

Different tissues of an organ perform their specific functions and these functions collectively become the function/s of that organ.

Example:

Stomach is an organ specialized for the digestion of proteins and for storing food.

Types of Tissue:

Two major types of tissues are present in its structure.

1. Epithelial (glandular) Tissue
2. Muscular Tissue

Epithelial (Glandular) Tissue:

Secretes the gastric juice for the digestion of proteins.

Muscular Tissue:

1. Performs contractions of stomach walls for grinding of food
2. Moving food to posterior end.

So two tissues perform their specific functions, which collectively become the function of stomach.

ORGAN SYSTEM LEVEL

Formation:

Different organs performing related functions are organized together in the form of an organ system.

Specialization in Function:

In an organ system, each organ carries out its specific function and the functions of all organs appear as one process of the organ system.

Example:

Digestive system is an organ system that carries out the process of digestion.

Major Organs:

Major organs in its framework are oral cavity, stomach, small intestine, large intestine, liver and pancreas. All these organs help in the process of digestion.

Organ System in Plants:

The organ system level is less complex in plants as compared to animals.

The complexity in Organ System Level:

The less complexity of organ system level in plants is due to a greater range of functions and activities in animals than in plants.

Q. No. 12 Write a note on individual level.

INDIVIDUAL LEVEL

Formation:

Different organs and organ systems are organized together to form an individual or organism.

Coordination in Organism:

In organism, the functions, processes and activities of various organs and organ systems are coordinated.

Example:

When a man is engaged in continuous and hard exercise, not only his muscles are working but also there is an increase in the rate of respiration and heart beat. This accelerated rate of respiration and heart beat supplies more oxygen and food to the muscles which they need for continuous work.

Q. No. 13 Write a note on population level.

POPULATION LEVEL

Biologists extend their studies to the population level where they study interactions among members of the same species living in the same habitat.

Definition:

A group of organisms of the same species located at the same place in the same time is called population.

Examples:

According to Ministry of Population Welfare, Government of Pakistan, human population in Pakistan in 2010 comprises of 173.5 million individuals.

Q. No. 14 Write a note on community level.

COMMUNITY LEVEL

Definition:

An assemblage of different populations, interacting with one another within the same environment is called community.

Example:

A forest may be considered as a community. It includes different plants, microorganisms, fungi and animal species.

Change in Population:

Communities are collections of organisms, in which one population may increase and others may decrease.

Effects of Change:

Any change in biotic or abiotic factors may have drastic and long lasting effects.

Complex Community:

Some communities are complex e.g. a forest community, a pond community etc.

Simple Community:

Some communities may be simple e.g. a fallen log with various populations under it. In a simple community number and size of populations is limited.

Q. No. 15 Write a note on biosphere level.

BIOSPHERE LEVEL

Definition: The part of the earth inhabited by organisms' communities is known as biosphere.

Composition: It constitutes all ecosystems.

Zone of Life:

Biosphere is called **Zone** of life on Earth.

Ecosystem:

The area where the living organisms interact with the nonliving components of environment is called as Ecosystem.

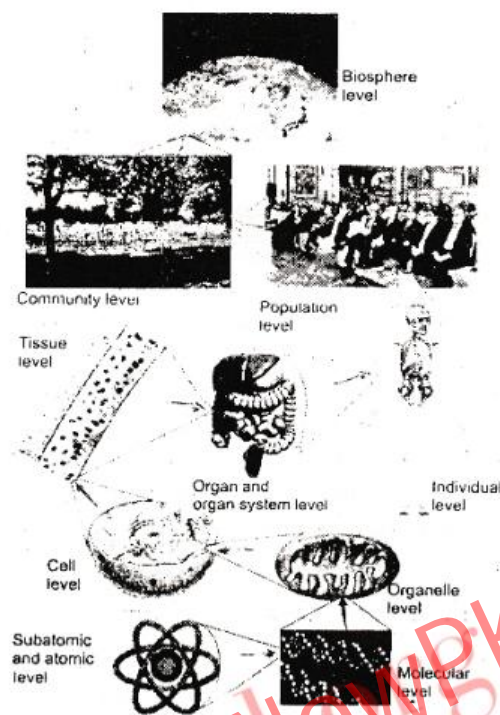



Figure: Levels of Organization

Q. # 16 Write a note on cellular organizations.

CELLULAR ORGANIZATIONS

Major Groups of Organisms:

All organisms have been divided into five major groups:

- Prokaryotes
- Protists
- Plants
- Animals
- Fungi

Types of Cells:

All organisms are made up of cells. There are two basic types of cells i.e.

- Prokaryotic
- Eukaryotic

Types of Cellular Organization:

In living organisms the cells organize in three ways to make the bodies of organisms.

1. Unicellular Organization
2. Colonial Organization
3. Multicellular Organization

1. Unicellular Organization:

The organisms formed through unicellular organization are called as unicellular organisms. In unicellular organisms only one cell makes the life of an organism. All the life activities are carried out by the only cell.

Examples:

- *Amoeba*
- *Paramecium*
- *Euglena*

Figure: *Amoeba* *Paramecium* *Euglena*

2. Colonial Organization:

In colonial type of cellular organization many unicellular organisms live together but do not have any division of labour among them.

Each unicellular organism in a colony lives its own life and does not depend on other cells for its vital requirements.

Figure: *Volvox* colony

Example:

- *Volvox*

Volvox:

Volvox is a green alga found in water that shows colonial organization. Hundreds of *Volvox* cells make a colony.

3. Multicellular Organization:

In multicellular organization cells are organized in the form of tissues, organs and organ systems.

Examples:

- Mustard plant
- Frog

MUSTARD PLANT: (*Brassica campestris*)

Cultivation Time:

Mustard plant is sown in winter and it produces seeds at the end of winter.

Types of Organs:

The organs of the body can be divided into two groups on the basis of their functions.

Vegetative Organs:

The organs which do not take part in the sexual reproduction of the plant are called vegetative organs.

Figure: Mustard Plant

Examples:

- Root
- Stem
- Branches
- Leaves

Reproductive Organs:

The organs which take part in sexual reproduction and produce fruits and seeds are called reproductive organs.

Example:

- Flowers

Uses:

- The plant body is used as vegetable
- Its seeds are used for extracting oil.

FROG: (*Rana tigrina*)

Frog shows the multicellular organization.

Organ Systems:

The body is made of organ systems and each organ system consists of related organs. All the organs are made of specific tissues:

- Epithelial
- Glandular
- Muscular
- Nervous

Figure: Frog

REVIEW QUESTIONS

MULTIPLE CHOICE

1. **Members of the same species living in the same place at the same time make a:**
   (a) Habitat (b) Biosphere
   (c) Community (d) Population
2. **If a scientist is studying the methods of inserting human insulin gene in bacteria, which branch of biology may this be?**
   (a) Anatomy (b) Physiology
   (c) Biotechnology (d) Pharmacology
3. **Which one will be the correct sequence of the levels of organization in life?**
   (a) Cell, organelle, molecule, organ, tissue, organ system, individual
   (b) Molecule, tissue, organelle, cell, organ system, organ, individual
   (c) Molecule, organelle, cell, tissue, organ, organ system, individual
   (d) Organ system, organ, tissue, cell, molecule, organelle, individual
4. **Which of these bioelements is in the highest percentage in protoplasm?**
   (a) Carbon (b) Hydrogen
   (c) Oxygen (d) Nitrogen
5. **Which of the following group includes organisms all of which are absorptive in their nutrition?**
   (a) Protists (b) Animals
   (c) Bacteria (d) Fungi

(3) **Draw a table showing the branches of biology and the studies these deal with.**

Branch of Biology	What it studies
Morphology	External form & structure of living organisms
Anatomy	Internal structures of living organisms
Histology	Tissues at microscopic level
Cell biology	Structure & functions of cells & organelles, and cell-division
Physiology	Functions of different parts of living organism
Genetics	Genes & their roles in inheritance
Embryology	Development of embryo to new individual
Taxonomy	Naming & classification of organisms
Paleontology	Fossils
Environmental biology	Interactions between organisms & environment
Socio-biology	Social behavior of animals
Parasitology	Parasites
Biotechnology	Application of living organisms for welfare of mankind
Immunology	Immune system & defense against invading microbes
Entomology	Insects
Pharmacology	Drugs & their effects on the systems human body

(4) **Give points to advocate that biology is linked with physics, chemistry, mathematics, geography and economics.**

Consult Long Question # 3

(5) **How would you distinguish a biomolecule from other molecules? What is the criterion for classifying a biomolecule as micromolecule or macromolecule?**

Difference between a 'molecule' and a 'biomolecule':

A Molecule is the smallest part of any compound that retains all the properties of that compound, being electrically neutral itself.

A Biomolecule is any molecule which is produced by living organisms.

All molecules cannot be biomolecules since biomolecules occur in living individuals only.

Criterion for classifying a 'Biomolecule':

A biomolecule can be of two types, based on their molecular weights:

- Micromolecule (of low molecular weight, e.g water, glucose etc.)
- Macromolecule (of heavy molecular weight, e.g. haemoglobin, DNA etc.)

(6) **Describe the levels of organizations of life.**

Levels of Organization:

i. Subatomic Level (particles that comprise an atom)
ii. Atomic Level (the smallest structural component of an element)
iii. Molecular Level (two or more atoms joined together via chemical bonds)
iv. Organelle Level (particular assembly of biomolecules)
v. Cellular Level (a composition of different organelles, the smallest unit of life)
vi. Tissue Level (a collection of cells performing a similar function)
vii. Organ Level (a collection of tissues performing a specific function)
viii. Organ System level (a collection of organs performing a specific function)
ix. Individual Level (a composition of organs and organ systems which are well-coordinated)
x. Population Level (a collection of organisms of same species living in the same habitat at the same time)
xi. Community Level (an assembly of different populations)
xii. Biosphere level (the zone of life, or the part of Earth inhabited by living organisms)

(7) **Is their any division of labour among the cells of a colony? If you find division of labour among cells and tissues what level of cellular organization is it?**

Colonial Mode of Life:

In a colony, every member has an independent existence. Every member lives its own life, and there is no division of labour among them.

Example:

A colony of *Volvox*, which is a freshwater alga, is formed by thousands of unicellular *Volvox* cells, but each cell is responsible for its own survival.

Multicellular Mode of Life:

If division of labour occurs between different types of cells, they get organized into various structural assemblies, such as tissues and organs, with cells performing similar functions. This happens in multicellular organisms, where cells make up a whole well-coordinated individual.

SHORT QUESTIONS

(1) **Define Biotechnology.**

Consult Long Questions # 2

(2) **What do you mean by Horticulture and how is it related to Agriculture?**

Horticulture:

It deals with the art of gardening. In horticulture, the work is for the betterment of existing varieties and for the production of ornamental plants and fruit plants.

Agriculture:

It deals with food crops and animals which are sources of food. In agriculture, the work is for the betterment of crops like wheat, rice, corn, etc and animals like buffalo, cow etc from which we get food.

Relationship:

Both these fields deal with the production and betterments of different organisms existing in nature. The difference lies in the types of organisms they deal with. Horticulture deals with ornamental and environment-beautification varieties of plants while agriculture deals with food-producing varieties of plants and animals.

THE TERMS TO KNOW

Agriculture: The branch of biology dealing with crops and animals which are sources of food.

Anatomy: The branch of biology dealing with internal structures of living organisms.

Animal husbandry: The branch of agriculture concerned with the care and breeding of domestic animals (livestock).

Biochemistry: The branch of biology dealing with chemistry of different compounds present in living organisms.

Bioeconomics: The branch of biology dealing with the study of organisms from economical point of view.

Bioelements: An element which takes part in making the body mass of an organism.

Biogeography: The branch of biology dealing with the study of occurrences and distribution of different species of living organisms in different geographical regions of the world

Biology: The study of living things, or life.

Biomathematics: The branch of biology dealing with the application of mathematical tools and techniques for data analysis.

Biomolecule: A molecule produced by living organisms.

Biophysics: The branch of biology dealing with the study of principles of physics applicable to biological phenomena.

Biotechnology: The branch of biology dealing with the practical application of living organisms to make substances for the welfare of mankind.

Botany: The branch of biology dealing with the study of plants.

Cell biology: The branch of biology dealing with cell organelles and cell division.

Colony: A collection of many independent organisms living together as a single unit.

Community: An assemblage of different populations, interacting with one another within the same environment.

Embryology: The branch of biology dealing with the development of an embryo to an individual.

Entomology: The branch of biology dealing with the study of insects.

Environmental biology: The branch of biology dealing with the study of interactions between organisms and their environment.

Farming: A profession dealing with maintenance and development of farms for better crops and production of animals which produce better meat and milk.

Fisheries: The professional study of fish production.

Forestry: The profession dealing with growth and maintenance of natural and artificial forests.

Fossil: The dead remains of ancient organisms.

Genetics: The study of genes and their roles in inheritance.

Histology: The microscopic study of tissues.

Horticulture: The field dealing with gardening, ornamental varieties of plants and fruits.

Immunology: The study of immune system and defense mechanisms of living things.

Inheritance: The transmission of characters from one generation to the other.

Macromolecule: A biomolecule with heavy molecular weight

Microbiology: The branch of biology dealing with the study of micro-organisms

Micromolecule: A biomolecule with low molecular weight

Microorganism: A very tiny organism not visible to the naked eye.

Morphology: The study of external form and structures of living organisms

Organ: A Collection of tissues performing a specific function

Organ-system: A collection of organs performing a specific function.

Organelle: A sub-cellular structure formed by a particular assembly of biomolecules

Paleontology: The branch of biology dealing with fossils

Parasite: Organisms which take food and shelter from living organisms and in return harm them

Parasitology: The branch of biology dealing with the study of parasites.

Pharmacology: The study of drugs and their effects.

Physiology: The study of normal functions of different body parts

Population: A group of species living in the same area at the same time.

Prokaryote: An organism which lacks a definite nucleus.

Protist: A plant-like, animal-like, or fungi-like organism, unicellular or simple multicellular organism.

Socio-biology: The study of social behaviors of animals which form societies.

Surgery: A profession dealing with repair, replacement or removal of body parts

Taxonomy: The branch of biology dealing with naming & classification of living organisms

Tissue: A group of similar cells performing a similar function

Volvox: A unicellular fresh water alga, which exhibits colonial mode of existence

Zoology: The branch of biology dealing with the study of animals.